

AD-A242 552



DTIC
ELECTE
NOV 18 1991
S c D

2

APPROVED FOR PUBLIC RELEASE
DISTRIBUTION UNLIMITED

REPORT NO. 91-R-03
AFPEA PROJ. NO. 88-P-108

JASON GILREATH

MECHANICAL ENGINEER

AUTOVON 787-3362

COMMERCIAL (513) 257-3362

QUALIFICATION TESTING OF VARIOUS
FASTENING DEVICES ON WOOD BOXES

HQ AFLC/DSTZ
AIR FORCE PACKAGING EVALUATION ACTIVITY
WRIGHT-PATTERSON AFB OH 45433-5999

OCT 1991

91-15737



91 1115 057

NOTICE

When government drawings, specifications, or other data are used for any purpose other than in connection with a definitely related government procurement operation, the United States Government thereby incurs no responsibility whatsoever, and the fact that the government may have formulated, furnished, or in any way supplied the said drawings, specifications, or other data, is not to be regarded by implication or otherwise as in any manner licensing the holder or any other person or corporation or conveying any rights or permission to manufacture use or sell any patented invention that may in any way be related thereto. This report is not to be used in whole or part for advertising or sales purposes.

ABSTRACT

In April 1988, the Air Force Packaging Evaluation Activity (AFPEA) initiated this project in order to find a better method of fastening the cover to the base of the MIL-B-26195 wooden box design in order to make the containers more reusable. The present design requires that new holes be drilled for the placement of the lag bolts after the container has been disassembled and reassembled several times.

Three boxes were constructed and tested at the AFPEA, HQ AFLC/LGTPD, Wright Patterson AFB, OH 45433-5999. Box number one utilized the present method of lag bolts into the skids as a control. Box number two consisted of bolts and blind nuts as the cover to base fasteners. Box number three used drywall screws as the fasteners.

The test plan was developed to evaluate how well the cover held to the base. The tests were conducted in accordance with Federal Test Method Standard 101C.

Results of the tests conducted on the prototypes show that bolts and blind nuts provided better fastening and nearly indefinite reusability.

PREPARED BY:

Jason Gilreath
Engineer Trainee
AFPEA

REVIEWED BY:

Ted Hinds
Ted Hinds
Ch, Design Branch
AFPEA

PUBLICATION DATE:

16 OCT 1991

APPROVED BY:

Charlie P. Edmonson
Charlie P. Edmonson
Chief, AF Packaging
Evaluation Activity

TABLE OF CONTENTS

ABSTRACT.....	i
TABLE OF CONTENTS.....	ii
INTRODUCTION.....	1
BACKGROUND.....	1
PURPOSE.....	1
DESCRIPTION OF TEST CONTAINER.....	1
TEST OUTLINE AND TEST EQUIPMENT.....	1
TEST PROCEDURES AND RESULTS.....	2
TEST NO. 1, EDGEWISE-DROP (ROTATIONAL) TEST....	2
TEST NO. 2, CORNERWISE-DROP (ROTATIONAL) TEST..	2
TEST NO. 3, SUPERIMPOSED LOAD TEST.....	2
TEST NO. 4, REPETITIVE SHOCK TEST.....	2
CONCLUSION.....	3
RECOMMENDATIONS.....	3
TABLE 1, CONTAINER TEST PLAN.....	4
TABLE 2, CONTAINER TEST PLAN.....	5
FIGURE 1, CORNER NUMBERING.....	6
FIGURE 2, LEAD DUMMY LOAD.....	7
FIGURE 3, EDGEWISE DROP (ROTATIONAL) TEST.....	8
FIGURE 4, CORNERWISE DROP (ROTATIONAL) TEST.....	9
FIGURE 5, CONTAINER NO. 3 FAILURE.....	10
FIGURE 6, SUPERIMPOSED LOAD TEST.....	10
FIGURE 7, REPETITIVE SHOCK TEST.....	11
DISTRIBUTION LIST.....	12

Accession For	
NTIS GRA&I	<input checked="" type="checkbox"/>
DTIC TAB	<input type="checkbox"/>
Unannounced	<input type="checkbox"/>
Justification	
By _____	
Distribution/	
Availability Code	
Page	Dist Avail and/or Special
	A-1



INTRODUCTION

BACKGROUND: The Air Force Packaging Evaluation Activity (AFPEA) initiated this project to find a better method of fastening the cover to the base of the PPP-B-601H wooden box design as a result of problems encountered in the field.

PURPOSE: The purpose of this project was to design a method of fastening the cover to the base of the MIL-B-26195 wooden box that was more reusable than the present method of lag bolts.

DESCRIPTION OF TEST CONTAINERS

One container, using the present method of lag bolts, was constructed as a control. Two other containers were made with two different types of cover to base fasteners. The corners of each of the three containers were numbered counterclockwise from the front right-side corner as shown in figure 1.

Design: Box no. 1 (control) used ten of the standard 3" X 3/8" lag bolts. Box no. 2 used ten sets of 4 1/2" X 3/8" bolts and 3/8" blind nuts. Box no. 3 used eighteen 2" drywall screws. All hardware was obtained off the shelf from a hardware store.

Construction: All containers were 36" X 26" X 33" built in accordance with PPP-B-601H and MIL-B-26195C style A.

TEST OUTLINE AND TEST EQUIPMENT

Test Plan: Tests were conducted in accordance with AFPEA Test Plan 88-P-108 (see attachment 1). The tests were developed to evaluate the structural integrity of the container with the new fasteners. Test methods, procedures and pass/fail criteria were in accordance with Federal Test Method Standard 101 (FTMS101C).

Test Load: All tests, except the superimposed load test, were conducted using a 1000 pound lead dummy load which was constructed at the AFPEA (see figure 2).

Test Site: All testing was conducted at the AFPEA, HQ AFLC/LGTPD, Building 70, Area C, Wright-Patterson AFB OH 45433-5999. The equipment required for each test is noted in the test plan.

TEST PROCEDURES AND RESULTS

Edgewise-Drop Test

Test No. 1: The edgewise-drop (rotational) test was performed in accordance with Method 5008.1. The drop height was 16" (see figure 3).

Results: Visual inspection revealed no damage to any of the containers.

Cornerwise-Drop Test

Test No. 2: The cornerwise-drop (rotational) test was performed in accordance with Method 5005.1. The drop height was 16" (see figure 4).

Results: Visual inspection revealed no damage to containers 1 and 2. On the second drop, container 3 failed. The skid pulled away from the cover section. After disassembly, it was found that all screws holding the cover to the base, except those on side 2-3, had been sheared off. One screw on side 1-4 was badly bent but not broken. This is because a chunk of wood from the end header had broken off before the screw could break (see figure 5). Due to this failure, no further testing will be done on container 3.

Superimposed Load Test

Test No. 3: The ambient superimposed load test was conducted in accordance with Method 5016.1. A load of 10,500 pounds was placed on top of a fully assembled container using a loaded base of another container, simulating a stack of containers 16 feet high with a safety factor of two (see figure 6).

Results: Visual inspection revealed no damage to containers 1 and 2.

Repetitive Shock

Test No. 4: The repetitive shock test was conducted in accordance with Method 5019.1. The containers were placed separately on the shaker table and blocked in with 1/2" spacing on all sides (see figure 7). A 1/16" vertical bounce was applied at 4.5 Hz with 1" double amplitude for two hours.

Results: Visual inspection revealed no damage to containers 1 and 2. All the fasteners on container 2 were still in place and tight. Four of the ten bolts in container 1 were loose as a result of the testing.

CONCLUSION

Containers no. 1 and no. 2 gave the same results when tested in accordance with the container test plan. As expected, some of the holes in container 1 were so worn out from the assembly and disassembly that new holes would need to be drilled for continued use of that container. Container no. 2 would never need to have the holes re-done. The drywall screws on container 3 were too weak to be acceptable due to the failure during the second drop test and it is also not probable that an increase in the number of screws would sufficiently improve this design.

RECOMMENDATIONS

It is recommended to use blind nut fasteners because of their reusability. An adhesive to hold the blind nuts in place permanently would be beneficial. If too much force is used when pushing the bolts through to the blind nuts, the nuts may be knocked out.

AIR FORCE PACKAGING EVALUATION ACTIVITY (Container Test Plan)					AFPEA PROJECT NUMBER 88-P-108	
CONTAINER SIZE (L x W x D) (INCHES)		WEIGHT (LBS)		CUBE (CU. FT.)	QUANTITY	DATE
INTERIOR:	EXTERIOR:	GROSS:	ITEM:			
33x24x26	36x26x33	1083	1000	17.7	3	11 Sep 91
ITEM NAME <u>Lead Dummy Load</u>				MANUFACTURER		
CONTAINER NAME <u>MIL-B-26195C Lag Bolt Test</u>					CONTAINER COST	
PACK DESCRIPTION <u>Wooden Container</u>						
CONDITIONING <u>As noted below.</u>						
TEST NO.	REF STD/SPEC AND TEST METHOD OR PROCEDURE NO'S	TEST TITLE AND PARAMETERS	CONTAINER ORIENTATION	INSTRUMENTATION		
1.	<u>EDGEWISE DROP</u> FED-STD-101C METHOD 5008.1	Container shall be dropped once on each bottom edge from a height of 16" for a total of 4 drops.	One edge shall rest on a 6" block.	Forklift or hoist		
2.	<u>CORNERWISE DROP</u> FED-STD-101C Method 5005.1	Container shall be dropped once on each bottom corner from a height of 16" for a total of 4 drops.	One corner shall rest on a 6" block, the adjacent corner shall rest on a 12" block.	Forklift or hoist		
COMMENTS:						
PREPARED BY: <u>JASON GILREATH, Engineer Trainee</u>				APPROVED BY: <u>TED HINDS, Chief, Design Br., AFPEA</u>		

AIR FORCE PACKAGING EVALUATION ACTIVITY (Container Test Plan)					AFPEA PROJECT NUMBER 88-P-108	
CONTAINER SIZE (L x W x D) (INCHES)		WEIGHT (LBS)		CUBE (CU. FT.)	QUANTITY	DATE
INTERIOR: 33x24x26	EXTERIOR: 36x26x33	GROSS: 1083	ITEM: 1000	17.7	3	11 Sep 9
ITEM NAME Lead Dummy Load				MANUFACTURER		
CONTAINER NAME MIL-B-26195C Lag Bolt Test				CONTAINER COST		
PACK DESCRIPTION Wooden Container						
CONDITIONING As noted below						
TEST NO.	REF STD/SPEC AND TEST METHOD OR PROCEDURE NO'S	TEST TITLE AND PARAMETERS	CONTAINER ORIENTATION	INSTRUMENTATION		
3.	<u>SUPERIMPOSED LOAD</u> FED-STD-101C METHOD 5016.1	Stack loaded base of one container onto another fully assembled container. Leave stacked for 1 hour. $\text{Weight} = P \times (16 - H) / H \times S$ $= 1083 \times (16 - 2.75) / 2.75 \times 2$ where P=weight of loaded container (lbs) H=height of container (ft) S=safety factor for level A packing	Bottom container is being tested. Test conducted at ambient temperature.	Record changes, i.e. buckling deformations		
4.	<u>REPETITIVE SHOCK</u> FED-STD-101C Method 5019.1	Test using vertical motion for two hours at $1 \pm .1$ G or 1/16" bounce between 3 to 5 Hz. Mount restraining blocks 1/2" away from sides of container	Ambient			
COMMENTS:						
PREPARED BY: JASON GILREATH, Engineer Trainee				APPROVED BY: TED HINDS, Chief, Design Br., AFPEA		

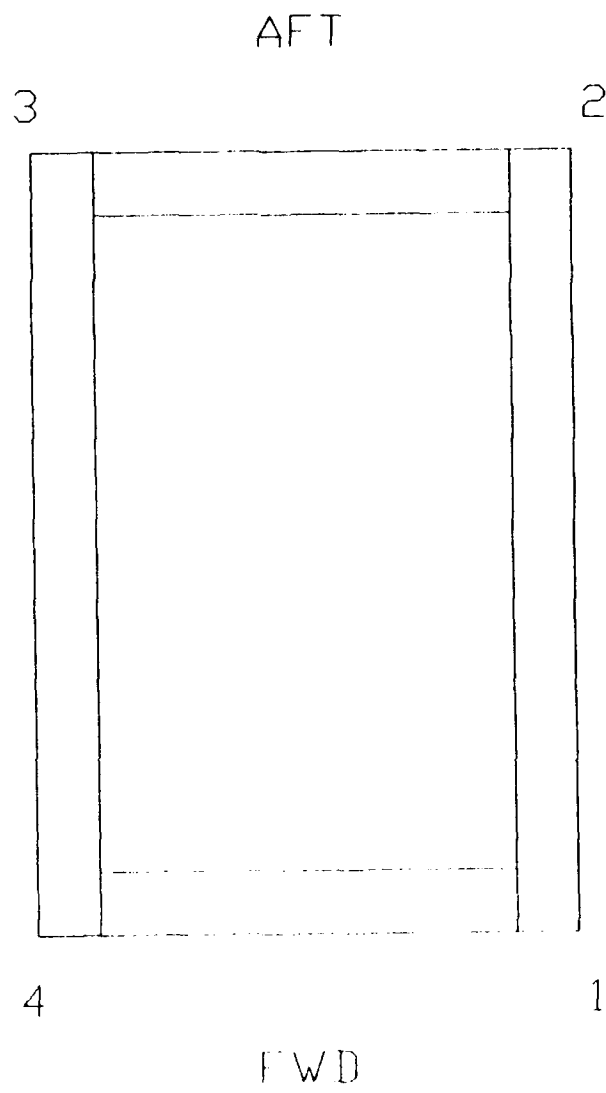


FIGURE 1. Corner Numbering



Figure 2: 1000 Pound Lead Dummy Load



Figure 3: Edgewise Drop - 16 inches
FTMS101C - Method 5008.1

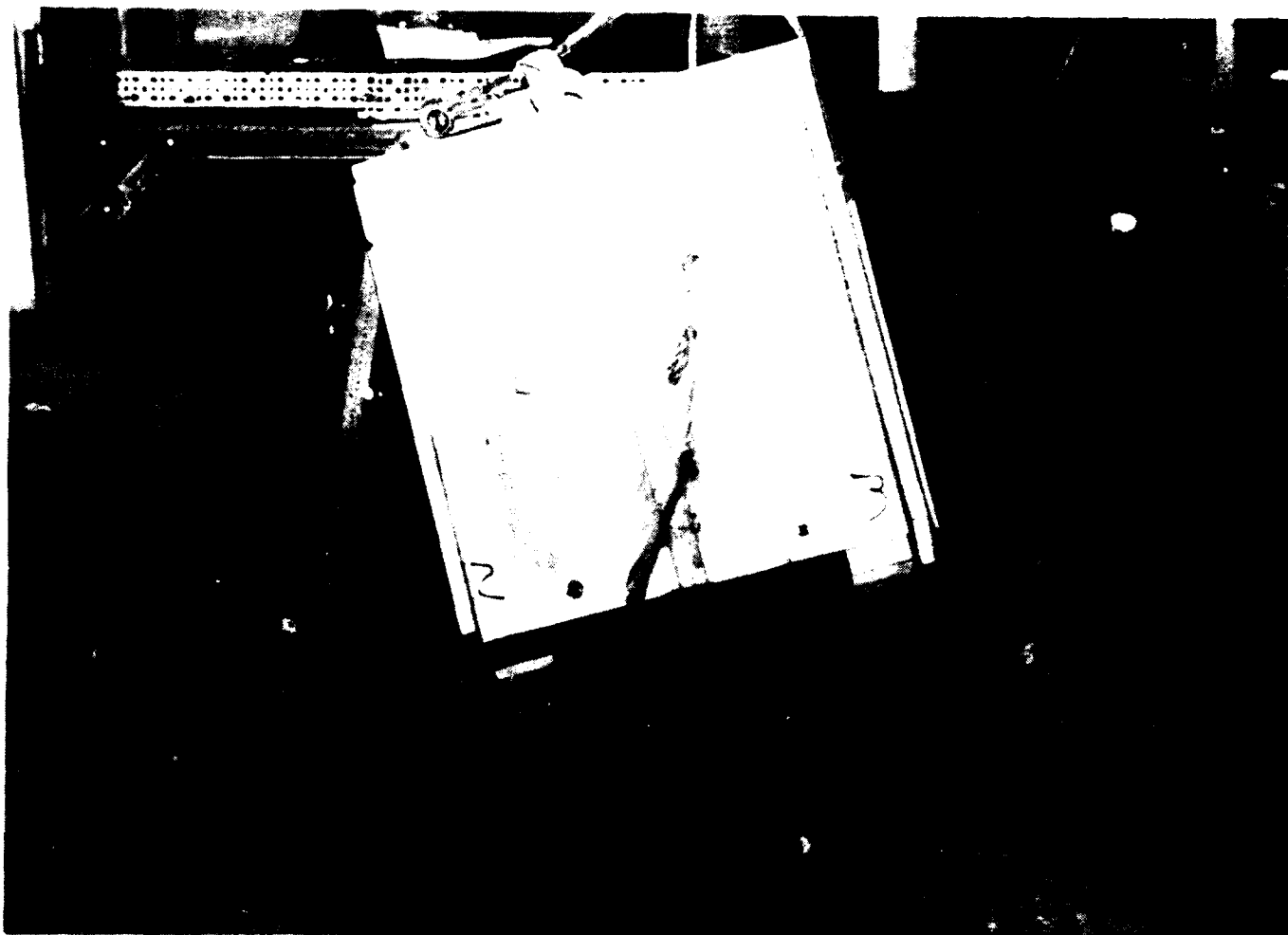


Figure 4: Cornerwise Drop - 16 inches
FTMS101C - Method 5005.1



Figure 5: Container 3 - Failed Cornerwise Drop

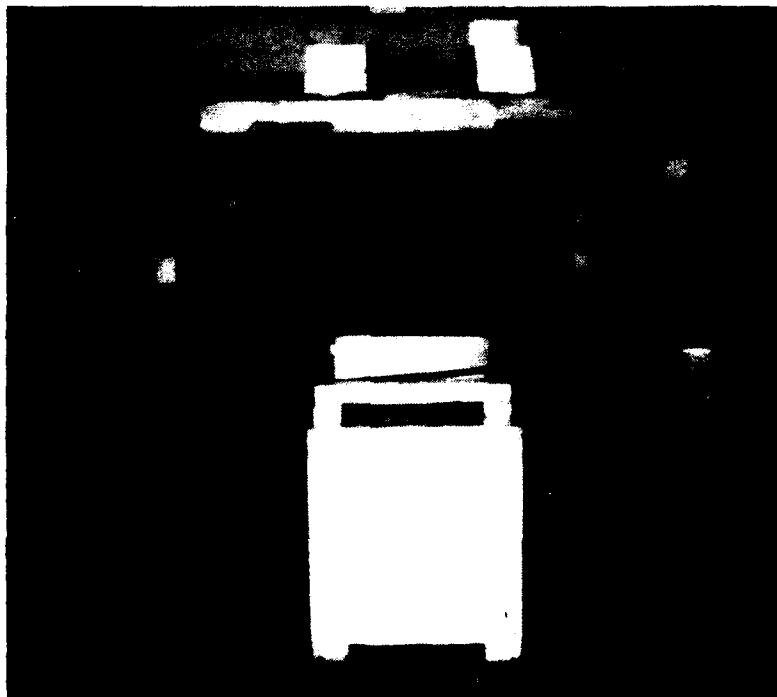


Figure 6: Superimposed Load Test - 10,500 pounds
FTMS101C - Method 5016.1

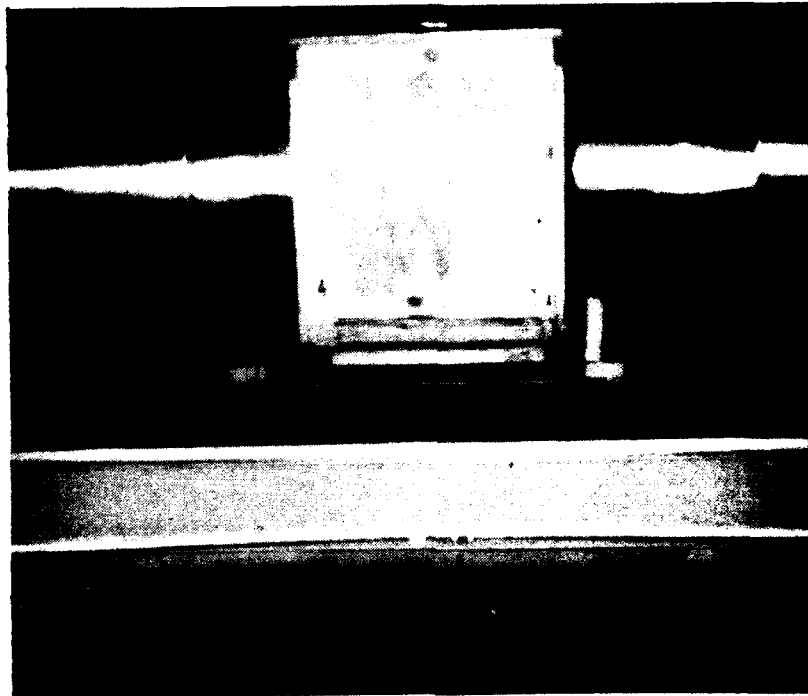


Figure 7: Repetitive Shock Test
FTMS101C - Method 5019.1

DISTRIBUTION LIST

DTIC/FDAC Cameron Station Alexandria, VA 22304-6145	12
HQ AFLC/LGT Wright-Patterson AFB OH 45433-5999	2
HQ AFLC/LGTPP Wright-Patterson AFB OH 45433-5999	2
HQ USAF/LGTT Washington DC 20330	1
HQ AFSC/LGT Andrews AFB MD 20334-5000	1
OC-ALC/DST Tinker AFB OK 73145	1
OO-ALC/TID Hill AFB UT 84406	2
SA-ALC/DST Kelly AFB TX 78241	1
SM-ALC/TID McClellan AFB CA 95652	1
WR-ALC/DST Robins AFB GA 31098	1
ASD/AWL Wright-Patterson AFB OH 45433	1
ASD/ALXP Wright-Patterson AFB OH 45433	2
ASD/YJA Eglin AFB FL 32542	2
GSA, Office of Engineering Mgt Packaging Division Washington DC 20406	1
Commander Naval Supply Systems Command Attn: N. Karl (SUP 0611F) Washington DC 20376-5000	1

Commander Naval Air Systems Command Attn: E. Panigot (AIR 41212A) Washington DC 20361	1
Commander Space and Naval Warfare Systems Command Attn: T. Corbe (Code 8218) Washington DC 20360	1
Commander Naval Facilities Engineering Command Hoffman Bldg. #2, Room 12S21 Attn: C. Manwarring (FAC 0644) Alexandria, VA 22332	1
Commanding Officer Naval Construction Battalion Center Attn: K. Pollock (Code 15611K) Port Hueneme, CA 93043	1
Commander Naval Sea Systems Command Attn: G. Mustin (SEA 66P) Washington DC 20362	1
Commander Naval Sea Systems Command Attn: F. Basford (SEA 05M3) Washington DC 20362	1
Commanding Officer Naval Aviation Supply Office 700 Robbins Avenue Attn: J. Yannello (Code EPP-A) Philadelphia, PA 19111-5098	1
Commanding Officer Navy Ships Parts Control Center P.O. Box 2020 Attn: F. Sechrist (Code 0541) Mechanicsburg, PA 17055-0788	1
Commanding Officer Naval Air Engineering Center Attn: F. Magnifico (SESD Code 9321) Lakehurst, NJ 08733-5100	1
Commanding Officer	2

(cont'd)

Naval Weapons Station Earle
NWHC/Code 8023
Colts Neck, NJ 07722-5000

ASO/TEP-A 4030
700 Robbins Ave
Philadelphia, PA 19111

US AMC Packaging, Storage, and
Containerization Center/SDSTO-T
Tobyhanna, PA 18466-5097

DLSIE/AMXMC-D
US Army Logistics Mgt Ctr
Ft Lee VA 23801-6034

US Army ARDEC/SMCAR-AEP
Attn: Mike Ivankoe
Dover, NJ 07801-5001

US Army Natick Labs/STRNC-ES
Natick MA 01760

HQ DLA/OWP
Cameron Station
Alexandria, VA 22304-6100

HQ AFLC/LGS
Wright-Patterson AFB OH 45433

ASD/SDM
Wright-Patterson AFB OH 45433

HQ TAC/LGWL
Langley AFB, VA 23665

OO-ALC/TIDT
Hill AFB, UT 84056

OO-ALC/LIW
Hill AFB, UT 84056-5609

Defense Logistics Agency
ATTN: DLA-OWP
Cameron Station
Alexandria VA 22304-6100

Defense Contract Management Command
ATTN: DLA-AT
Cameron Station

(cont'd)

Alexandria VA 22304-6190